REMARKS

In the last Office Action, the Examiner objected to the drawings under 37 C.F.R. §1.83(a) as failing to show a second insulating film overlying the thin film resistors and second conductors formed on the second insulating film, as recited in claim 2. Claim 2 was rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Claims 1-4, 10-15, 17-20, 24-31 and 34-36 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,296,726 to MacElwee. Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of U.S. Patent No. 5,708,284 to Onishi. Claim 1 was further rejected under the judicially created doctrine of double patenting over claim 1 of U.S. Patent No. 6,369,409 to Takasu et al. ("Takasu").

In accordance with the present response, claim 2 has been amended to overcome the drawing objection and the rejection under 35 U.S.C. §112, first paragraph. More specifically, with reference to the embodiment shown in Fig. 2, claim 2 has been amended to clarify that the first conductors 201-203 are connected to the thin film resistors 105-107 and to the second conductors 401-403 so that each of

the thin film resistors 105-107 is at the same potential as a respective one of the first conductors 201-203 and a respective one of the second conductors 401-403. Support for the clarifying amendment to claim 2 is found in the description on pages 10-12 of the specification as originally filed. Claim 34 has been amended to cure two instances of indefiniteness by deleting the inadvertent duplicate recitation of "first conductors" (lines 8-9) and changing "the end" to "an end" (line 11).

In view of the foregoing, applicants respectfully submit that the objection to the drawing under 37 C.F.R. §1.83(a) and the rejection of claim 2 under 35 U.S.C. §112, first paragraph, have been overcome and should be withdrawn.

The amendments to the claims made herein do not raise new issues requiring further search and/or consideration. Instead, claim 2 has been amended to overcome the drawing objection and the rejection under 35 U.S.C. §112, first paragraph, raised by the Examiner, and claim 34 has been amended to cure two instances of indefiniteness, thereby placing the application in condition for allowance or in better form for appeal.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached pages are captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**".

Applicants respectfully request reconsideration of their application in light of the following discussion. The present invention is directed to a semiconductor device.

SUMMARY OF THE INVENTION

In conventional bleeder resistance circuits using thin film resistors, there is a problem that a voltage division ratio becomes inaccurate frequently. Furthermore, in a conventional bleeder resistance circuit coordinating a MOS transistor in the same chip, there has been such a problem that a resistance value change due to the temperature of polysilicon thin film resistors is large in a region of high sheet resistance value, and the sheet resistance value has to be set small in order to obtain high voltage division accuracy in a wide temperature range. As a result, the area occupied by the bleeder circuit region requiring a high resistance value at one meg-ohm or higher becomes larger.

The present invention overcomes the drawbacks of the conventional art. Fig. 2 shows an embodiment of the semiconductor device according to the present invention embodied in the claims. The semiconductor device has thin film resistors 105-107 connected in series to form a bleeder resistance circuit. Each of the thin film resistors 105-107 is made of a polysilicon film doped with B or BF_2 P-type impurities and has two end portions each having a high

impurity concentration region (P^+ region). A first insulating film 404 overlies the thin film resistors 105-107. First conductors 201-203 are connected to the ends of the thin film resistors 105-107 for connecting the thin film resistors in series. Each of second conductors 401-403 is connected to a respective one of the first conductors 201-203 and overlies a respective one of the thin film resistors 105-107 through the first insulating film 404.

Preferably, a second insulating film 405 overlies the thin film resistor 105-107. The first conductors 201-203 are connected to the thin film resistors 105-107 and to the second conductors 401-403 so that each of the thin film resistors 105-107 is at the same potential as a respective one of the first conductors 201-203 and a respective one of the second conductors 401-403.

By the foregoing construction, a semiconductor device is provided which has a bleeder resistance circuit of high accuracy and having an accurate voltage division ratio and a small temperature coefficient of a resistance value.

The prior art of record does not disclose or suggest the subject matter recited in claims 1-4, 10-20, 24-31 and 34-36.

Traversal of Prior Art Rejections

Claims 1-4, 10-15, 17-20, 24-31 and 34-36 were rejected under 35 U.S.C. §103(a) as being unpatentable over

MacElwee. While not indicated by the Examiner in the heading (page 3) of this rejection (pg. 3), the body (pgs. 4-5) of this rejection refers to U.S. Patent No. 6,372,585 to Yu which is relied upon by the Examiner for its disclosure of a polysilicon layer implanted with boron or BF_2. For the purpose of responding to this rejection, applicants presume that the Examiner intended to reject claims 1-4, 10-15, 17-20, 24-31 and 34-36 under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Yu.

Applicants respectfully traverse this rejection and submit that the combined teachings of MacElwee and Yu do not disclose or suggest the subject matter recited in claims 1-4, 10-15, 17-20, 24-31, and 34-36.

Independent claim 1 is directed to a semiconductor device and requires a plurality of thin film resistors connected in series to form a bleeder resistance circuit, each of the thin film resistors being made of a polysilicon film doped with B or BF_2 P-type impurities and having two end portions each having a high impurity concentration region. Independent claim 1 further requires a first insulating film overlying the thin film resistors, a plurality of first conductors connected to the ends of the thin film resistors for connecting the thin film resistors in series, and a plurality of second conductors each connected to a respective one of the first conductors and overlying a respective one of

the thin film resistors through the first insulating film. No corresponding structural combination is disclosed or suggested by MacElwee.

Independent claim 34 is also directed to a semiconductor device and requires a plurality of thin film resistors overlying the first insulating film and electrically connected in series by the first conductors, each of the thin film resistors being made of a polysilicon film doped with B or BF_2 P-type impurities and overlying a respective one of the first conductors. Again, no corresponding structural combination is disclosed or suggested by MacElwee.

The primary reference to MacElwee discloses a resistive load structure having two thin film accumulation mode field effect transistors connected in series with a common node and separate gate electrodes. Contrary to the Examiner's contention, MacElwee does not disclose or suggest a plurality of thin film resistors electrically connected in series, as required by independent claim 1 and 34. Likewise, as recognized by the Examiner, MacElwee does not disclose or suggest that each of the thin film resistors is made of a polysilicon film doped with B or BF_2 P-type impurities, as required by independent claims 1 and 34. For example, as shown in Fig. 2 of MacElwee, a polysilicon layer 50 is selectively doped by ion implantation to form heavily doped N+ regions 54 and heavily doped N+ region 56, leaving relatively

lightly doped resistive regions 58 (col. 5, lines 9-16). Thus MacElwee clearly does not disclose or suggest a plurality of P-type polysilicon thin film resistors connected in series, as required by independent claims 1 and 34.

Moreover, independent claim 1 requires that the P-type polysilicon thin film resistors are connected in series to form a bleeder resistance circuit. No corresponding electrical structure is disclosed or suggested by MacElwee. For example, in Fig. 1 of MacElwee a resistor 10 comprises a body formed from a resistive conductive layer of polysilicon which is lightly p- or n-doped to provide a resistive region 12 having a desired resistivity range (col. 4, lines 42-45). The resistor 10 in MacElwee clearly does not constitute a bleeder resistance circuit, as required by independent claim 1.

The Examiner cited the secondary reference to Yu for its disclosure of a semiconductor device containing a polysilicon layer implanted with boron or BF_2. The Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the resistive load structure of MacElwee by incorporating boron or BF_2 in the polysilicon layer in order to reduce effective boron energy and significant amporphization of the surface silicon as taught by Yu. Applicants respectfully disagree with the Examiner's contention and conclusion of obviousness.

While disclosing a polysilicon layer implanted with boron or BF_2, Yu does not disclose or suggest a plurality of P-type polysilicon thin film resistors connected in series, as required by independent claims 1 and 34. Likewise, Yu does not disclose or suggest P-type polysilicon thin film resistors are connected in series to form a bleeder resistance circuit, as required by independent claim 1. Since Yu does not disclose or suggest these structural features, it does not cure the deficiencies of MacElwee. Accordingly, one of ordinary skill in the art would not have been led to modify MacElwee in view of Yu in the manner proposed by the Examiner in the statement of rejection. The only basis for the combinations urged by the Examiner in the rejection is applicants' own disclosure, and such hindsighted rejections are improper. See, for example, Diversitech Corp. v. Century Steps, Inc., 7 USPQ2d 1315, 1318 (Fed. Cir. 1988); In re Geiger, 2 USPQ2d 1276, 1278 (Fed. Cir. 1987); Panduit Corp. v. Dennison Manufacturing Co., 227 USPQ 337, 343 (Fed. Cir. 1985); Interconnect Planning Corp. v. Feil, 227 USPQ 543, 551 (Fed. Cir. 1985).

Claims 2-4, 10-15, 17-20, 24-31 and 35-36 depend on and contain all of the limitations of independent claims 1 and 34, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1 and 34.

Moreover, there are separate grounds for patentability of dependent claims 2 and 36.

With reference to the embodiment of Fig. 2, amended claim 2 includes the additional limitation that a second insulating film 405 overlies the thin film resistors 105-107, and that the first conductors 201-203 are connected to the thin film resistors 105-107 and to the second conductors 401-403 so that each of the thin film resistors 105-107 is at the same potential as a respective one of the first conductors 201-203 and a respective one of the second conductors 401-403. Claim 36 requires a second insulating film overlying the plurality of thin film resistors, a plurality of second conductors formed on the second insulating film and each overlying a respective one of the thin film resistors, and second connecting means conductively connecting one end of each the thin film resistors to a respective one of the second conductors so that each of the thin film resistors is at the same potential as the respective one of the second conductors. No corresponding structural combination is disclosed or suggested by the prior art of record.

Accordingly, applicants respectfully submit that claims 1-4, 10-15, 17-20, 24-31 and 34-36 patentably distinguish over the prior art of record and that the rejection of the claims under 35 U.S.C. §103(a) should be withdrawn.

Claim 16 was rejected under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Onishi.

Applicants respectfully traverse this rejection and submit that the combined teachings of MacElwee and Onishi do not disclose or suggest the subject matter recited in claim 16.

MacElwee does not disclose or suggest the subject matter recited in amended independent claim 1 as set forth above for the rejection of claims 1-4, 10-15, 17-20, 24-31 and 34-36 under 35 U.S.C. §103(a). Claim 16 depends on and contains all of the limitations of amended independent claim 1 and, therefore, distinguishes from the reference at least in the same manner as claim 1.

The secondary reference to Onishi was cited by the Examiner for its disclosure of a memory device containing a conductor layer formed of a lamination layer containing a barrier metal and a silicide layer. However, Onishi clearly does not disclose or suggest the structure of the semiconductor device recited in amended independent claim 1, including the recited structure of the thin film resistors and the recited structural relationship among the thin film resistors, first insulating film and first and second conductors. Since Onishi does not disclose or suggest these features, it does not cure the deficiencies of MacElwee. Accordingly, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

In view of the foregoing, applicants respectfully request that the rejection of claim 16 under 35 U.S.C. §103(a) as being unpatentable over MacElwee in view of Onishi be withdrawn.

Claim 1 was rejected under the judicially created doctrine of double patenting over claim 1 of Takasu. Applicants respectfully submit that amended claim 1 is patentably distinct from claim 1 of Takasu.

Amended independent claim 1 requires a plurality of thin film resistors connected in series to form a bleeder resistance circuit, each of the thin film resistors being made of a polysilicon film doped with B or BF_2 P-type impurities. While reciting a plurality of polysilicon thin film resistors, claim 1 of Takasu does not recite that <u>each of the thin film resistors is made of a polysilicon film doped with B or BF_2 P-type impurities</u>, as required by amended independent claim 1. Accordingly, amended independent claim 1 patentably distinguishes from claim 1 of Takasu.

In view of the foregoing, applicants respectfully request that the rejection of claim 1 under the judicially created doctrine of double patenting over claim 1 of Takasu be withdrawn.

The amendments to the claims made herein do not raise new issues requiring further search and/or consideration. Instead, claim 2 has been amended to overcome

the drawing objection and the rejection under 35 U.S.C. §112, first paragraph, raised by the Examiner, and claim 34 has been amended to cure two instances of indefiniteness, thereby placing the application in condition for allowance or in better form for appeal.

In view of the foregoing amendments and discussion, the application is now believed to be in condition for allowance. Accordingly, entry of this amendment and favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicants

By: _____
Bruce L. Adams
Reg. No. 25,386

50 Broadway - 31st Floor
New York, NY 10004
(212) 809-3700

MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: MS AF COMMISSIONER FOR PATENTS, P.O. Box 1450, Alexandria, VA 22313-1450, on the date indicated below.

Debra Buonincontri
Name

Debra Buonincontri
Signature

June 24, 2003
Date

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claims 2 and 34 have been amended as follows:

2. (Amended) A semiconductor device according to claim 1; further comprising a second insulating film overlying the thin film resistors; wherein the first [second] conductors are connected to the thin film resistors and to the second conductors [formed on the second insulating film in a position over the thin film resistors] so that each of the thin film resistors [are] is at the same potential as a respective one of the first conductors and a respective one of the second conductors.

34. (Amended) A semiconductor device comprising:

a plurality of first conductors;

a first insulating film overlying the first conductors;

a plurality of thin film resistors overlying the first insulating film and electrically connected in series by the first conductors, each of the thin film resistors being made of a polysilicon film doped with B or BF_2 P-type impurities and overlying a respective one of the first conductors; and

[first conductors for electrically connecting the thin film resistors in series; and]

first connecting means for electrically connecting each of the first conductors to [the] an end of a respective one of the thin film resistors so that each of the first conductors is at the same potential as the respective one of the thin film resistors.